

Red Willow's Clean Air Program

Presented by:

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Introduction

Experience

Emissions Testing

Title V –Major Source Permitting

Clean Air Act Regulatory Consulting

Fossil Power and Industrial Plant Experience

B.S. from Penn State 1977

Joined Red Willow in 2007



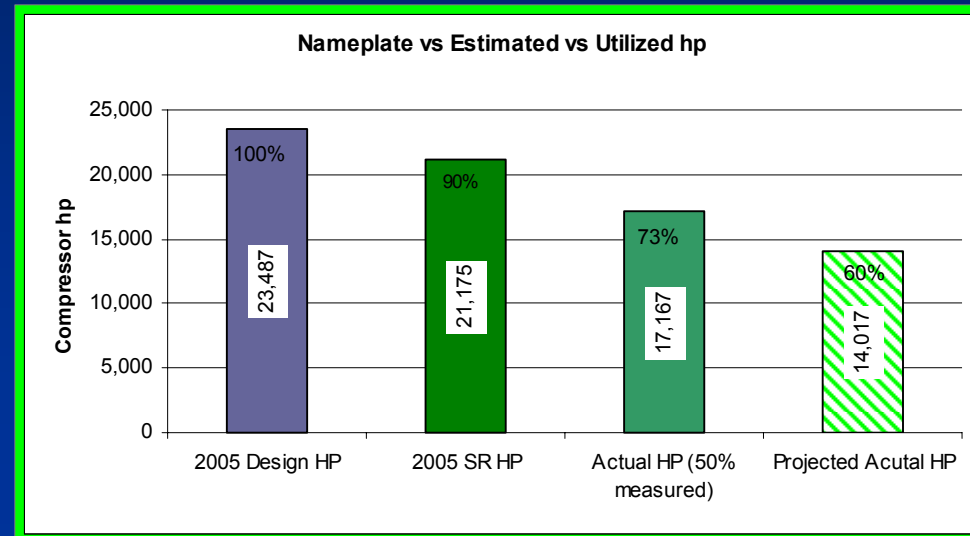
Red Willow's Commitment

- Implement an Internal Company Clean Air Policy
 - New engines placed today will comply with future regulations to achieve early compliance.
 - All new units start with EHS review and approval
 - Existing units will be replaced or tuned based on test results even if not required to do so (BMP).
 - Maintain a test, tune and test program to measure performance (BMP).
 - Measure program effectiveness in Enertia tracking compressors and emissions data



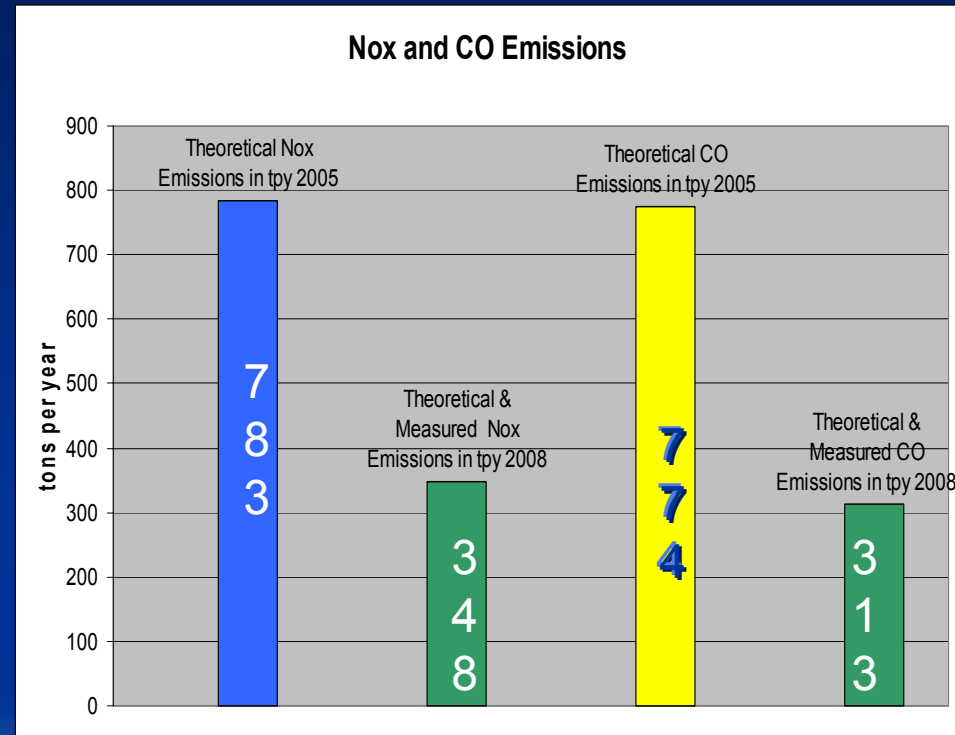
Our Footprint on air quality is based on Inventories

- Horsepower is one key inventory component.
- Past practice based on vendor rated hp
- Values inherently biased high
- Testing tells the actual story
- 2005 Engine design max. hp
- 2005 Elevation corrected hp
- 2008 Site utilized hp (with 50% measured)
- NOTE: measured hp uses pressures, flows, RPM's, exhaust O₂ and vendor curves
- 2008 Best estimate of utilized on-reservation hp



Rated vs Measured Emissions Inventory on the Reservation

- Vendor's rated emissions are another component- often rated at full load.
- Actual Emissions based on tested values and site measured hp
- Testing completed on 50% of compressors - July 2008
- 2005 NO_x (theoretical)
- 2008 NO_x (measured 50%, theoretical 50%)
- 2005 CO (theoretical)
- 2008 CO (measured 50%, theoretical 50%)
- More testing offers addl. actual reductions



Red Willow's Clean Air Policy

- Internal guidance document initiated in 2008
- Update and refine the 2005 emission inventory
- Maintain compressors, engines, and emissions history in Enertia
- Prioritize replacements and upgrades
- All new compressors start with EHS approval
- Test, Tune, and Test new & existing equipment.
- Continuously track progress to measure effectiveness



Best Management Practices

- Tune & Optimize Existing Units
- Add AFRC and Catalyst
- Seek Best Available Technology
- Utilize “No-Bleed” Pneumatic Devices
- Reduce hp and emissions where it makes business sense.
- Tuning and leaning reduces emissions and may use less fuel.
- Seek units that package low emissions and noise control all in 1.



Example AFRC and Catalyst

- Waukasha F2895G @ 33-10 #34-5



Case Study-Test, Tune, and Test

- Cat 3306 rated at 126 hp & 22 grams NOx = 26.8 tons per year (Theoretical)
- Site de-rating reduces hp to 110 and NOx = 23.4 tons per year
- Testing showed 56 hp is actually utilized and NOx was 12.1 grams = 6.5 tons per year
- Tuning and re-testing reduced NOx to 6.0 grams @ 56 hp or = 3.2 tons per year (Actual).
- Unit is running fine and delivers the same volume of gas today
- Actual NOx emissions are 90% less than theoretical emissions



FUTURE PROJECTS

- Test and tune the balance of compressors on reservation
- Install “EMIT Technology” on a trial basis on a Pump Jack Engine and evaluate
- Install smaller, cleaner, quieter, low emission package compressors on a trial basis
- Seek 1 gram NO_x and 2 gram CO emitting units for all new replacement compressors
- Investigate vapor recovery vs. flaring gas where it makes business sense
- Investigate the use of no-bleed pneumatic devices on reservation



Summary and Conclusions

- Progress is being made on all fronts.
- Test, tune, and test reduces emissions and optimizes hp.
- Indicates where smaller cleaner engines can be used.
- Continue meeting our obligations for using best available emission controls and setting a high standard for other operators.

